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Two-Way Street Conversion: Evidence of Increased Livability in Louisville

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Abstract

While recent policies directed toward multimodal or complete streets have encouraged increased funding for bicycle- and pedestrian-oriented projects, many streets are still plagued by unsafe conditions. This is especially true for one-way streets, which studies show often create unsafe crossing conditions. This study evaluates changes to street dynamics after a two-way street conversion in Louisville, Kentucky. We find that traffic flow increased after implementation of two-way flow, but traffic accidents decreased. We also note other ancillary benefits, such as increase in property values and reduced crime. These results provide evidence that conversions can promote mobility, safety, and livability.

Keywords

one-way streets, two-way streets, traffic, housing, livability

Streets are the lifeblood of a city; they shape many aspects of neighborhood life, like housing values, health, safety, foreclosures, and crime. Three years before the *Death and Life of Great American Cities* came out, Jane Jacobs (1958) wrote, "The best place to look at first is the street.… The street works harder than any other part of downtown. It is the nervous system; it communicates the flavor, the feel, the sights. It is the major point of transaction and communication. Users of downtown know very well that downtown needs not fewer streets, but more, especially for pedestrians" (p. 127). At a time when many are moving to urban centers in search of walkable, livable, and sustainable neighborhoods, cities must reevaluate streetscapes designed for auto mobility (Ehrenhalt 2009; J. Jacobs 1958, 1961). Autocentric lifestyles are a consequence of the post-1950s suburban revolution, when planners and engineers facilitated the creation of multilane, one-way streets to accommodate quick transport (Appleyard 1981; Hall 1996; Handy, Paterson, and Butler 2003; Jackson, 1987). New York, for example, had no one-way streets until the 1950s (Dover and Massengale 2013).

Some of the greatest urban thinkers, from Jane Jacobs to Andres Duany, have recognized the potential destructiveness of the multilane, one-way street (Duany, Plater-Zyberk, and Speck 2001). Many believe that these streets create unsafe and unfriendly conditions for pedestrians and bicyclists (Edwards 2002) as well as stifle commercial corridors—leaving neighborhoods open to decay (Ehrenhalt 2012). In spite of these concerns, there has been scant evaluation of the impact that converting these corridors to two-way streets would have. Therein lies the purpose of this study—to explore the impacts of the conversion of one-way, multilane streets to two-way streets.

Louisville, Kentucky, exemplifies the type of midsized urban center that once had a thriving downtown with two-way streets (as depicted in Figures 1 to 3). In the 1950s and 1960s, the city had converted these downtown streets into thoroughfares to allow for efficient travel between the city and suburbs. Recently, however, Louisville began converting these multilane, one-way streets back to two-way flow. We evaluate the before-and-after impacts of this conversion on (1) traffic collisions, (2) crime, and (3) property values. Beyond theory, we are unaware of any studies that have completed detailed, quasiempirical examinations of what happens when multilane one-way streets are converted. We first introduce the background and literature on the topic. We then describe our methodology and the evaluation of the street conversions in this before-and-after case study. This leads to our discussion and conclusions.

Background

Prior to the 1950s, two-way streets were the predominant design in urban areas. Though they were deemphasized for a number of years, the concept is now resurgent, based on work

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Figure 1. 1890s downtown Louisville, Kentucky; two-way street traffic, street cars, and pedestrians.
Source: University of Louisville Photo Archives (http://digital.library.louisville.edu/cdm/singleitem/collection/potter/id/640/rec/214/rec/214).

Figure 2. 1950s downtown Louisville, Kentucky; two-way street traffic and abundant pedestrians.
Source: University of Louisville Photo Archives (http://digital.library.louisville.edu).

by Jacobs, Appleyard, Southworth, Ewing, and Cervero. Jacobs and Appleyard developed the concept of the street's relation to livability (Appleyard 1981; A. Jacobs 1993; A. Jacobs and Appleyard 1987). Jacobs and Macdonald designed places, such as the Octavia corridor in San Francisco, that had tree-lined medians separating slow residential streets from two-way lanes of traffic. This design theory employed some of the same virtues of two-way boulevards espoused by Frederick Law Olmsted. These well-designed, narrow streets had generous sidewalks and pedestrian amenities associated with increased walking and cycling behavior (Cervero and Kockelman 1997; Ewing et al. 2006; Southworth 2005).

Only a handful of studies have specifically looked at the quantitative implications of multilane, one-way street conversions. Cross-sectional evaluations are more common in the literature and have shown that multilane, one-way streets are often less safe than their two-way counterparts (Ewing and Dumbaugh 2009). Other literature has established that one-way streets allow motorists to speed from one destination to another (Schneider, Grembek, and Braughton 2013), increasing the risk to pedestrian safety (Swift, Painter, and Goldstein 1998). Increased speed poses negative safety implications for communities (Papaioannou 2007; Stemley 1998), and one study suggests that multilane, one-way streets are a psychological issue for drivers—providing a false sense of security that can promote faster driving (Holahan 2013).

Though multilane one-way streets benefit auto mobility, research shows that this benefit comes at the expense of the young and elderly, who are more at risk to be involved in a crash (Oxley et al. 2005; Oxley, Fildes, and Dewar 2004; Petch and Henson 2000; Wazana et al. 2000). Oxley et al. (2005) emphasizes the potential safety benefits of reduced lanes and crossing distances, something that has been reinforced by literature showing the safety benefits of road diets (Dumbaugh and Rae 2009; Huang, Stewart, and Zegeer 2002; Schneider et al. 2010). Research also shows a strong correlation between higher traffic speeds and greater chance that pedestrians and drivers will die in collisions (Edwards and Mason 2014; Rifaat, Tay, and de Barros 2011). For example, a bike rider hit by a motorist going faster than 15 miles per hour is 14.1 times more likely to need hospital attention and 2.6 times more likely to be killed (Rivara, Thompson, and Thompson 1997; Vanderbilt 2008).

Speed is directly correlated with street width (Swift et al., 1998); and since wider streets are a characteristic of one-way streets, one might infer by association that there could be potential benefits of two-way versus one-way streets. Yet, very little quantitative social science exists on the full range of impacts of multilane, one-way streets or their impacts on communities. One of the few quantitative studies suggests that two-way streets can be designed to serve a greater automobile capacity if left turns are banned (Gayah and Daganzo 2012). In this way, both livability and efficiency objectives can be achieved in parallel. Such work draws on more flexible interpretation of American Association of State Highway and Transportation Officials guidelines but does not provide actual case studies or concretely define livability implications of varying street typologies (Chiu, Zhou, and Hernandez 2007). One non-peer-reviewed paper documented the process of completing street conversions in Denver with a qualitative bent but did not assess the impacts (Dorroh and Kochevar 1996). A few other papers advocate "placemaking" theory, which supports one-way–to–two-way conversions and offers methods to explore them but not the actual implications of these conversions (Lyles, Faulkner, and Syed

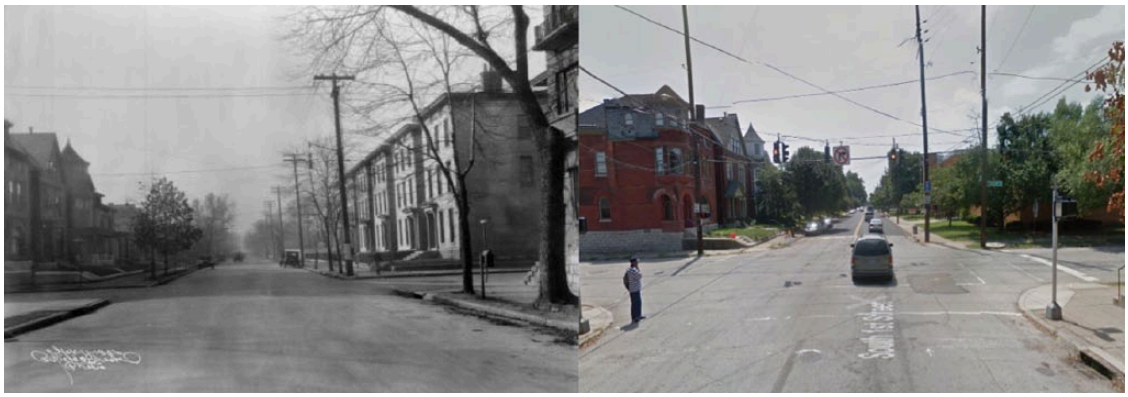

Figure 3. 1929 and 2013 segment comparison.
Source: University of Louisville Photo Archives (http://digital.library.louisville.edu/cdm/singleitem/collection/cs/id/970/rec/17).

2000; Walker, Kulash, and McHugh 2000). There are some professionally oriented reports that discuss the potential benefits of conversions with a more qualitative bent. For example, the Urban Land Institute suggests, in many of its publications, that converting from one-way to two-way streets should be a part of urban development and regeneration strategies (Beyard, Pawlukiewicz, and Bond 2003; Dunphy, Myerson, and Pawlukiewicz 2003).

Given this background, we posit that the multilane, one-way street design can be harmful to downtown communities and that conversion to two-way streets can positively affect downtown communities in terms of mobility, safety, economic resilience, and livability. Some qualitative work already suggests that multilane, one-way streets lower housing values and hurt businesses. When motorists travel at high speeds, houses and businesses are less appealing, and it is more difficult to notice and curtail illegal activities and crime (Hanka and Gilderbloom 2008). While these are complex, multivariate issues, we hypothesize that two-way streets can positively impact urban communities in a variety of ways, including increased pedestrian safety, decreased traffic and traffic collisions, reduced crime rates, and increased property values. This paper will further detail and analyze the validity and scope of these potential impacts.

Methodology

Study Site

This study explores the consequences of converting multilane, one-way streets to two-directional traffic. It measures the effects of conversion by quantifying changes along stretches of two major one-way thoroughfares, the couplet of Brook Street and 1st Street, in Louisville, Kentucky, which was converted from one-way to two-way in 2011. This conversion occurred at a cost of roughly $250,000, for both 1.25-mile segments and was funded using a portion of programmed regional State Transportation Improvement Program (STIP) funding. The budget included stoplight and sign conversion, along with signal timing and restriping. We compare these changes with an adjacent couplet, 2nd and 3rd Streets, which remained one-way.

The respective street segments span approximately 1.25 miles over 10 blocks and five census tracts in Louisville's urban core, in a neighborhood known as Old Louisville. Historically, this was one of the city's first suburbs, and it is still located within 2 miles of downtown along the Ohio River to the north. In the late 1800s it was home to wealthy Ohio River ship captains, and in the 1920s it was glamorized as the home of rich socialite Daisy Buchanan in F. Scott Fitzgerald's *The Great Gatsby*. (Old Louisville is still known for having one of the largest collections of Victorian houses in the nation.) While the streets were originally designed as two-way, after World War II (as the city expanded to house returning GIs), transportation engineers began to focus more on automobile speed and mobility. Similar to many urban locations, the Old Louisville neighborhood experienced disinvestment, when affluent homeowners left and the concentration of minorities, primarily black, increased (Gilderbloom, Riggs, and Meares 2015; Riggs 2014). Today the neighborhood has approximately 13,000 residents. While it is racially mixed, it still has a large share of blacks (44 percent). As indicated in Table 1, 83 percent of the housing is rental, with many older homes converted to low-income housing. The median income ranges from $16,000 to $27,000, far lower than the median income of $45,352 for Louisville as a whole.

Louisville is an ideal choice for our research. It is a midsized U.S. city that, unlike megacities, such as like New York or Los Angeles or San Francisco, is representative of hundreds of other small to midsized cities in the United States and internationally (Applebaum 1976; Gilderbloom and Appelbaum, 1987). Louisville has a relatively monocentric

Table 1. Neighborhood Demographics.

	Old Louisville							Louisville Metro	
Demographic	Tract 51 *n*	Tract 50 *n*	Tract 52 *n*	Tract 62 *n*	Tract 66 *n*	Total *n*	%	*n*	%
White	1,788	704	2,501	477	1,391	6,861	51	552,976	75
Black or African American	1,382	883	814	2,229	606	5,914	44	164,196	22
American Indian and Alaska Native	52	14	64	32	30	192	1	5,581	1
Asian	35	68	90	16	42	251	2	19,824	3
Native Hawaiian and other Pacific Islander	3	7	4	10	2	26	0	1,058	0
Some other race	29	23	40	32	16	140	1	15,474	2
Median age (years)	47.2	47.3	28.8	25.1	31.7			37.9	
Total housing units	2,490	1,150	2,265	1,115	1,370	8,390	100	337,616	100
Occupied housing units	2,149	896	2,004	875	1,106	7,030	84	309,175	92
Owner-occupied housing units	193	99	374	217	334	1,217	17	194,997	63
Renter-occupied housing units	1,956	797	1,630	658	772	5,813	83	114,178	37
Average household size	1.44	1.52	1.68	2.82	1.8			2.35	
Median household income (dollars)	16,920	15,638	24,987	17,875	27,896			45,352	
Per capita income (dollars)	12,855	19,702	27,834	11,269	20,330			26,473	

Source: 2010 Census, Demographic Profile (DP) 1; 2010 American Community Survey (ACS) five-year estimates, DP3.

urban landscape, with surrounding suburban rings of decentralized development, which is characteristic of older industrial cities grappling with the effects of deindustrialization and suburbanization (Appelbaum 1978; Appelbaum et al. 1976; Gilderbloom, Meares, and Riggs 2014).

The conversion to two-way streets resulted from concerns of local Louisville citizens and politicians, which began in 2010. These individuals argued that two-way streets would improve the neighborhood's economic vitality and livability and believed the conversion would increase safety. Since the streets were wide, there was room for two lanes of traffic and a bike lane, with no impact on parking. With the help of local authorities, the neighborhood procured regional transportation funding to conduct the conversions. When interviewed by the media, Louisville Metro councilman David James, a former Louisville police officer, described his support of the street conversion as follows:

> My number one responsibility to the residents… is their safety. This ordinance offers an effective means to regulate traffic and makes these neighborhoods safer for everyone. At the same time, it will enhance the unique character of the Old Louisville area. More two-way streets are an important part of our strategy to renew historic neighborhoods near downtown.… Slowing this traffic down not only means safer streets for families, but also additional economic development in the neighborhood. Storefront exposures go through the roof when traffic is slowed, as opposed to cars simply driving by only paying attention to the cars around them and how fast they are going. (James 2011)

Analysis Procedure

Data for 1st and Brook Streets was collected and analyzed before and after the 2011 conversion began. Nearby 2nd and 3rd Streets operated as a control, since these streets remained one-way. The parallel and adjacent 2nd and 3rd Streets make an appropriate control group to benchmark, because they have operated as a couplet with Brook and 1st since they were converted to two-way streets in the 1950s. Both street couplets share similar geography and design typologies. Both have posted speed limits of thirty-five miles per hour, neither has marked bike lanes, and none of the conversions were accompanied by reduced speed limits. There was higher average daily traffic on 2nd and 3rd because of two large retail establishments along the corridor—a land use that had always struggled on Brook and 1st.

There were three variables studied: (1) traffic collisions, (2) crime, and (3) property values. In addition to quantitative analysis, qualitative research was conducted in the form of personal interviews and neighborhood canvassing, using a snowball sampling method. We interviewed twenty-eight neighborhood residents and community leaders to uncover additional contextual aspects related to these conversions. Figure 4 illustrates the relative location of the streets in the city.

Collisions and Traffic Volume

Collision data came from the Kentucky Collision Analysis for the Public and the Kentucky State Police. It includes crashes between vehicles, between vehicles and bicycles, and between vehicles and pedestrians. Incidents between bicycles and pedestrians are not accounted for, due to lack of reliable recording mechanisms. These data were complemented by traffic volume data from the Kentuckiana Regional Planning and Development Agency Regional Traffic Count Database, which was verified by the Kentucky Transportation Cabinet.

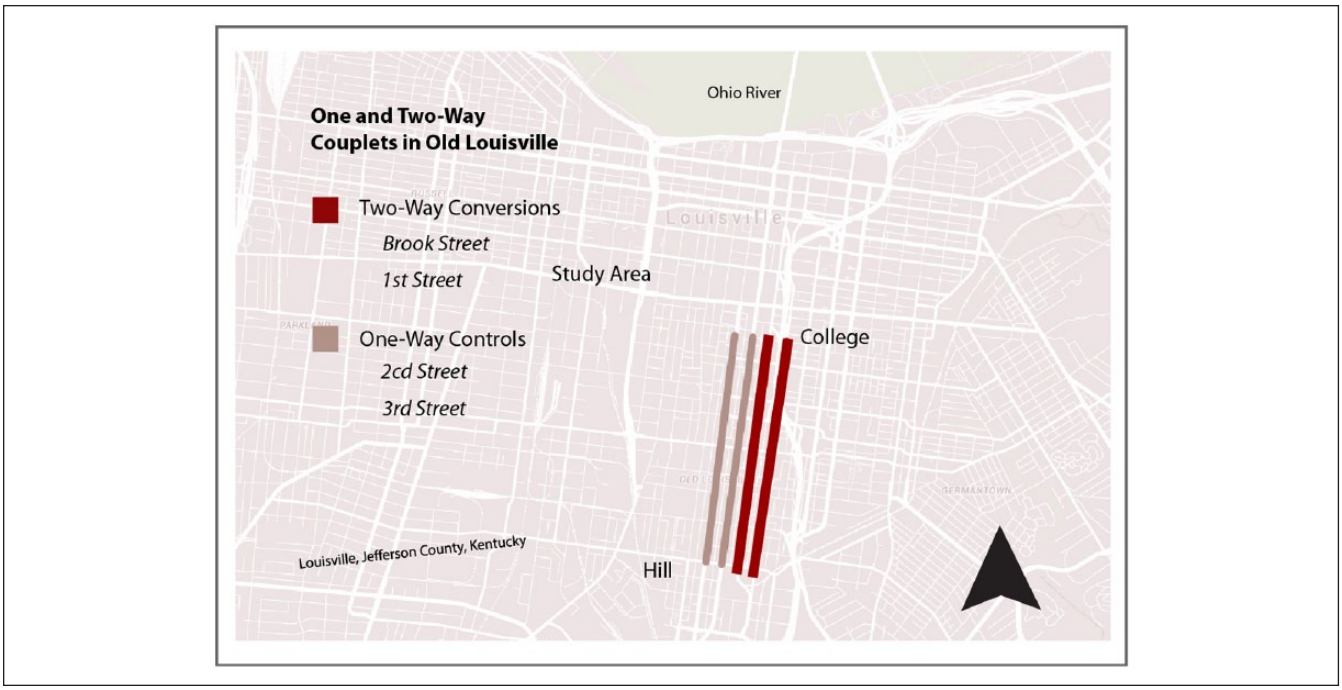

Figure 4. Location of two-way conversion and control streets.
Source: U.S. Census Bureau; Kentuckiana Regional Planning and Development Agency Regional Traffic Count Database; Louisville/Jefferson County Information Consortium.

To measure potential change, monthly collision rates from three time periods were analyzed. The rates/periods studied included (1) the average number of collisions per month during the five-year period before the conversion, (2) the average number of collisions per month in the twelve months immediately following the conversion, and (3) the average number of crimes per month in the year following the first year. One limitation of the analysis is that the twelve months postconversion were dramatically different than prior years. Nevertheless, this three-step comparison, combined with traffic volume information, provided a normalizing effect. To further mitigate this limitation, we collected the same data on an adjacent, parallel segment, 2nd and 3rd Streets, as a control group.

For the period prior to conversion, the monthly collision rate along Brook and 1st Streets was calculated over a five-year period. This was done to develop a normalized trend. To evaluate potential impacts or changes after the conversion, we evaluated the two post-conversion years separately. We assumed that the first twelve months immediately following the conversion involved some volatility, as drivers adjusted to new traffic patterns and route decisions. The second twelve-month period was evaluated using a monthly average, compared to the preconversion period. Here we show the data, for each of the two twelve-month periods after conversion, to illustrate impacts and minimize the skewing effects caused by externalities and moderating factors. Pre- and postconversion collision data were statistically significant, at the 95 percent confidence interval, with a 5 percent margin of error.

Crime

Crime data come from the Louisville Metro Police Department. Total crime was tabulated for Brook and 1st Streets as well for our control group, 2nd and 3rd Streets, in a similar manner to the data collected for collisions. This includes all types of crimes reported along the entire corridor for the four study streets; however, we categorized by auto and property crimes, for illustrative purposes. The crime totals for each street were broken down by (1) average number of crimes per month during the five-year period before the conversion, (2) average number of crimes per month in the twelve months immediately following the conversion, and (3) average number of crimes per month in the year following the first year. We calculated the monthly average by analyzing five years of crime data over the five-year period previous to the street conversion. Data collected over this duration were less likely to be skewed by one specific event along the corridor. It is also worth noting that the area around Brook and 1st Streets is a high-crime area. Thus, it is unlikely that a decrease or increase in crime rates, following the street conversion, is an anomaly but illustrates a relationship between the street conversion and crime. Pre- and postconversion crime levels were statistically significant, at the 95 percent confidence interval, with a 7 percent margin of error.

Property Values

Property value data came from Jefferson County Property Value Administration (PVA). The PVA sales history data were collected for the entire converted sections of Brook and

Table 2. Number of Collisions Pre- and Postconversion.

Street	Collisions previous 5 years	Collisions per mo. previous 5 years	Collisions first year postconversion	Collisions per mo. first year postconversion	% Change	Collisions >1 year postconversion	Collisions per mo. >1 year postconversion	% Change
$Brook_{Conversion}$	193.00	3.22	28.00	2.33	–27.46	31.00	2.07	–35.75
$1st_{Conversion}$	229.00	3.82	40.00	3.33	–12.66	23.00	1.53	–59.83
$2nd_{One\text{-}Way}$	312.00	5.20	75.00	6.25	20.19	96.00	6.40	23.08
$3rd_{One\text{-}Way}$	250.00	4.17	56.00	4.67	12.00	58.00	3.87	–7.20

Source: Collision Analysis for the Public; Kentucky State Police.

1st Streets. These data were compared to sales data of parallel segments of the control couplet, 2nd and 3rd Streets. Looking at sales data allowed for an estimation of positive, negative, or no change in property value assessment, from the most recent date prior to the 2011 conversion to the most recent date after the 2011 conversion, in comparison to a nearby location with no conversion. Once the sales history data were gathered, the annual percentage growth rate was calculated to determine how much a particular property in the study area increased, decreased, or remained the same in between sales dates. The median value change was also determined for each street. These data provided an accurate picture of property values between multilane, one-way and two streets.

The following formula was applied to determine the annual percentage growth rate:

$$\text{Annual \% Growth Rate} = \frac{\left(\begin{array}{l}\text{present value} - \\ \text{past value}\end{array}\right)}{\left(\text{past value}\right)} \times 100$$

$$\text{Annual \% Growth Rate} = \frac{\text{Total from 1}}{\text{N}}$$

N = Present Value Year – Past Value Year

The following formula was applied to determine the average annual percentage growth rate:

$$\text{Average Annual \% Growth Rate} = \frac{\left(\begin{array}{l}\text{Total Annual \%} \\ \text{Growth Rate}\end{array}\right)}{\begin{array}{l}\text{Total Number} \\ \text{of Properties}\end{array}}$$

In addition to property assessment and sales history data, current sales prices of properties on Brook, 1st, 2nd, and 3rd Streets were compared to their most recent sales prices. Current property sales prices were collected from Zillow.com. The annual percentage growth rate was calculated for current properties for sale. The property assessment data analysis determined how many properties had increased, decreased, or stayed the same, from the most recent preconversion assessment to the most recent postconversion assessment. Pre- and postconversion PVA data were statistically significant, at the 95 percent confidence interval, with a 7 percent margin of error. While we report the summary of our results, for the interested, detailed tables are provided in an online supplemental appendix.

Interviews

A total of forty interviews in these neighborhoods complemented quantitative assessment of crash and volume data, using a snowball sampling method that focused on neighborhood residents and community leaders. These interviews gleaned information unavailable through analytical work. The interviews were typically ten to forty-five minutes long. Participants were split almost equally between men and women, although the sample somewhat skewed toward women. Most were neighborhood residents, with a few businesses owners. The rough question framework was as follows: (1) Have you noticed changes since the conversion from one- to two-way streets? If so, what kind? (2) In your opinion, what is the benefit(s) of one-way streets? Of two-way streets? (3) What do you think makes a street more inviting and "livable"? Responses were transcribed and coded using qualitative software. They were then analyzed using a code co-occurrence framework to look for common themes in the data. All interviews were anonymous and complied with appropriate protection-of-human-subjects protocols.

Results and Discussion

Traffic Collisions

Our results confirmed existing literature that shows a relative decrease in collisions when streets change to two-way. As shown in Table 2, following the conversion of Brook and 1st Streets, there was a 36 percent and 60 percent reduction in total collisions per month, respectively. On 2nd and 3rd Streets, data showed a 23 percent increase and a 7 percent decrease in total collisions per month, respectively. Since Brook and 1st Streets and 2nd and 3rd Streets acted as couplets, we expected traffic would shift from Brook and 1st to 2nd and 3rd to avoid slower speeds after the conversion. We assumed many drivers would prefer multilane, one-way streets so they could take advantage of the faster travel speeds along those routes (Vanderbilt, 2008).

Table 3. Traffic and Collision Rate Pre- and Postconversion.

Preconversion					Postconversion				
Street	ADT	Monthly traffic[a]	Collisions per month	Total collisions	ADT	Monthly traffic[a]	Collisions per month	Total collisions	Percentage change
$Brook_{Conversion}$	3,473	105,647	3.22	32,843	3,934	119,659	2.07	57,899	–43.27
$1st_{Conversion}$	3,673	111,730	3.82	29,274	5,145	156,493	1.53	102,061	–71.32
$2nd_{One\text{-}Way}$	8,880	270,100	5.20	51,942	7,700	234,208	6.40	36,595	41.94
$3rd_{One\text{-}Way}$	8,440	256,716	4.17	61,612	7,550	229,645	3.87	59,391	3.74

Source: Collision Analysis for the Public; Kentucky State Police; Kentuckiana Regional Planning and Development Agency Regional Traffic Count Database.
Note: ADT = average daily traffic.
[a]Monthly traffic was calculated by multiplying the ADT by 365 and dividing by 12.

We discovered the opposite was true. There was a 13 percent increase in traffic on Brook Street and a 40 percent increase on 1st Street. This traffic increase was accompanied by 13 percent reduction on 2nd Street and 11 percent reduction on 3rd Street in traffic volume. The net traffic volume along all four streets combined was unchanged. These data confirm literature that suggests that two-way streets can function at a higher capacity while being safer. It flips the conventional wisdom of traffic engineers who assume that drivers choose the fastest route from point A to point B. In fact, people might choose a route based on other factors—beauty, interesting historical sites, safety, scenery, restaurants—and choose lower speeds. It is also one of our more surprising findings since traffic engineers typically claim that two-ways reduce maximum capacity of a road, making it inefficient use of tax payer money and resources (Vanderbilt 2008, 7).

This finding is consistent with literature that evaluates the impacts of information, education, and experiences on individual agents (Axhausen et al. 2002; Ben-Elia, Erev, and Shiftan 2008). For example, travel behavior, taken from (or "scraped" from) online reviews, may indicate different trends whereby route distance does not dictate trip (Mondschein 2014). Furthermore, literature suggests that for immigrant communities and other vulnerable populations, traditional utility-based mode choice and traffic modeling frameworks may not be as effective, given stark differences in the sociocultural environmental (Hutabarat 2009a, 2009b, 2011).

Though it appears that faster cars may have shifted to 2nd and 3rd Streets (perhaps resulting in total crash increases even as total traffic volume fell), local traffic appears to have shifted to Brook and 1st in response to the vastly increased mobility options (no more circling the block back and forth in order to find the one-way street leading to a destination). In order to get an accurate measurement of collision rate changes on the streets, it was necessary to calculate a per capita rate—a rate of crashes per number of vehicles traveling along the street. To do this, the daily traffic average was multiplied by 365 and then divided by 12 to get a monthly vehicle average for each street, which could then be compared to the number of collisions per months by dividing them. This comparison led to one of the most startling and compelling arguments of all. While Brook Street saw a 43 percent reduction in the number of collisions per vehicle driven, 1st Street saw a 71 percent reduction in collisions, as shown in Table 3. What had been the most dangerous street statistically, prior to the conversion, became the safest by far.

Paralleling the reduction in collisions, and consistent with our hypothesis, an improvement was noted in neighborhood livability, with reduced crime and increases in property values. While these factors may be somewhat linked to one another, our data show striking improvements in a short period, which should provide additional justification for two-way conversion.

Crime

Results of the crime analysis (shown in Figure 5) show 15 percent and 30 percent reductions in overall crime on Brook and 1st Streets, respectively. On 2nd and 3rd Streets, the crime statistics were dissimilar: crime increased by 16 percent on 2nd street and decreased by 16 percent on 3rd Street. These trends occurred against a 5 percent overall increase in crime within Louisville Metro between 2010 and 2013. The likeliest explanation of these trends is that a shift in crime from Brook and 1st Streets to 2nd Street occurred as a result of reduced speeds, making a "getaway" more difficult. Auto thefts and robberies decreased specifically. Auto thefts on Brook and 1st Streets reduced by 33 percent and 23 percent, respectively. The robbery rate along Brook and 1st Streets dropped 33 percent and 50 percent, respectively, while the robbery rate in the neighborhood trended down overall between the preconversion and postconversion periods. On 2nd and 3rd Streets, we found 13 percent and 10 percent reductions, respectively. Figures 6 and 7 show these changes.

Property Assessments

With regard to property values, our assessment showed overall property assessments increased after the 2011

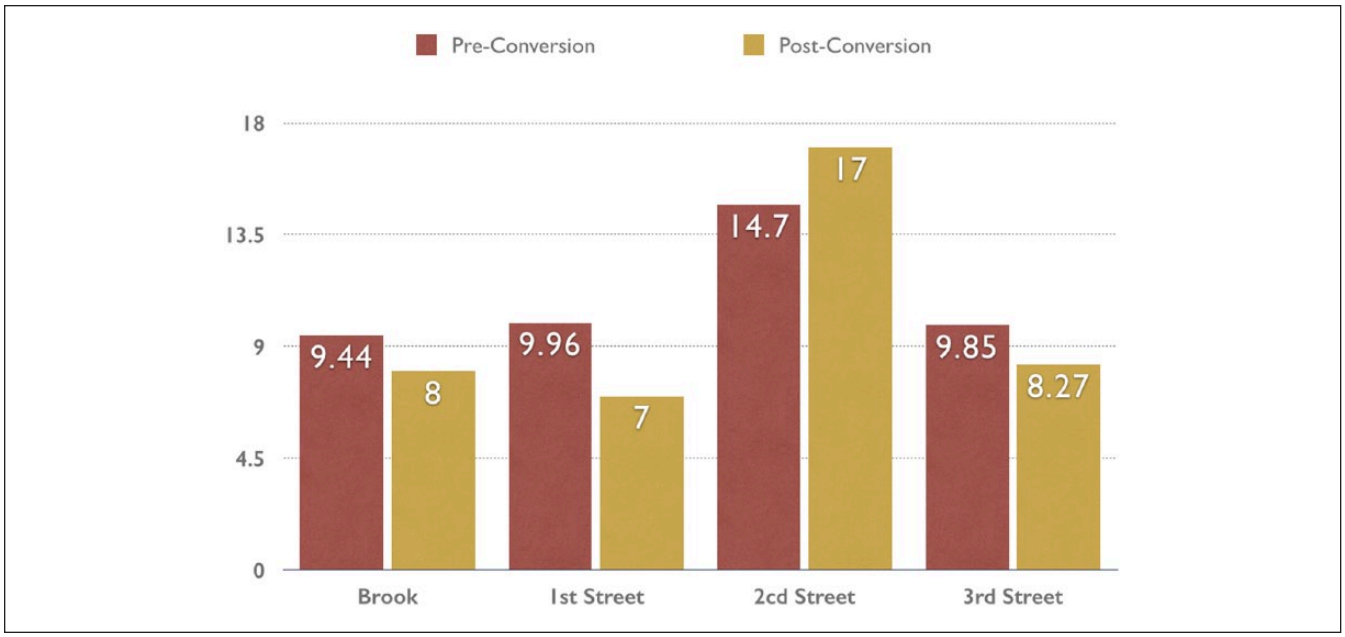

Figure 5. Total crimes per month.
Source: Louisville Metro Police Department.

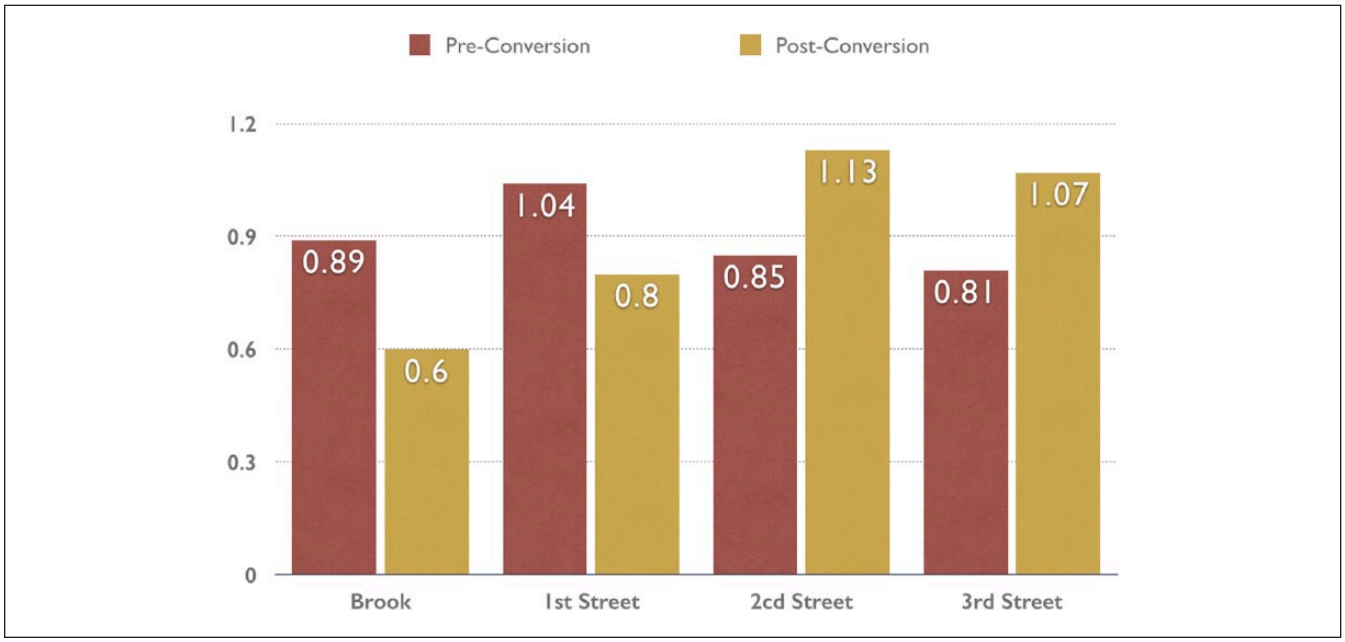

Figure 6. Auto thefts per month.
Source: Louisville Metro Police Department.

two-way street conversion. This increase in property values occurred at a time when Louisville's housing prices, as a whole, were declining slightly (Federal Housing Finance Agency [FHFA] 2013). Of the seventeen properties on Brook Street that sold in 2013, eleven properties had a positive annual growth percentage since their last sale, five properties had a negative annual growth percentage since their last sale date, and one property had neither a positive nor a negative annual growth percentage since its last sale.[1] The average annual percentage growth rate for Brook Street was 38.97 percent. The median property value change was 2.55 percent. In comparison to the data collection and analysis of 1st, 2nd, and 3rd Streets, the Brook Street average annual percentage was surprisingly high. These data suggest

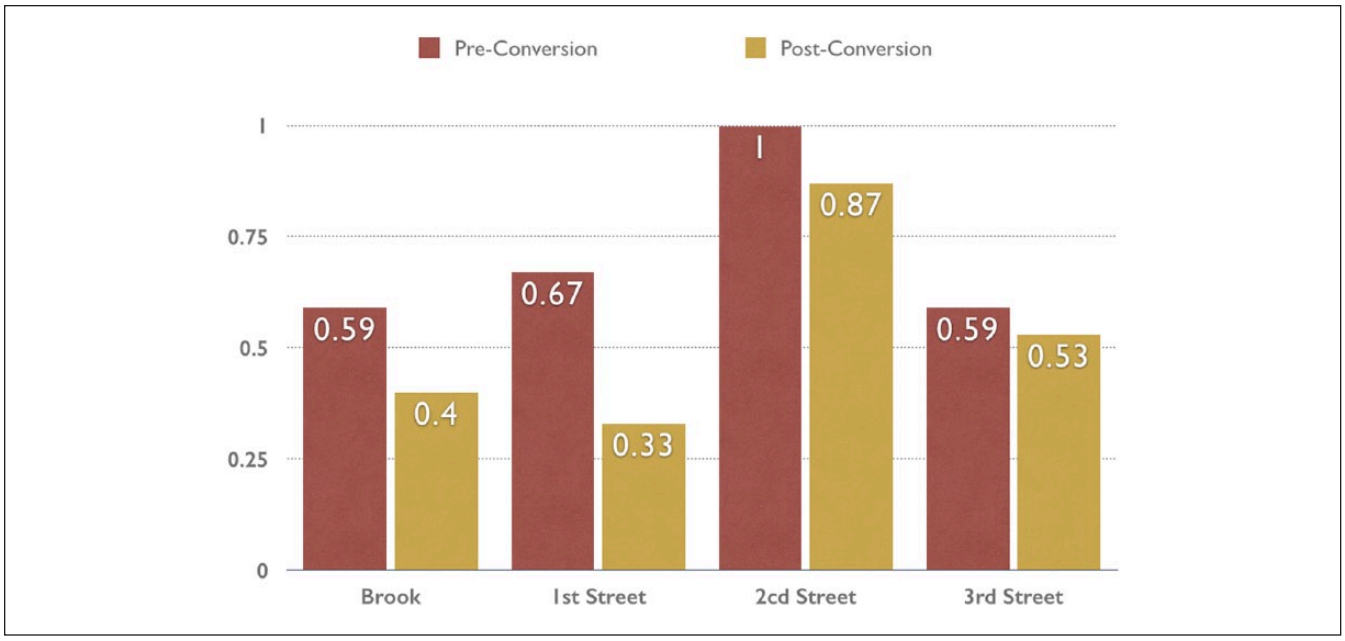

Figure 7. Robberies per month.
Source: Louisville Metro Police Department.

that property values on Brook Street increased as a consequence of the 2011 street conversion.

For 1st Street, twenty-three properties received property valuation assessments prior to and after the 2011 conversion. Overall, property assessments increased after the 2011 two-way street conversion.

Of the twenty-four properties on 1st Street that sold in 2013, sixteen properties had a positive annual growth percentage since their last sale, and eight properties had a negative annual growth percentage since their last sale date. The average annual percentage growth rate for 1st Street was 2.78 percent. In comparison to the data collection and analysis of 2nd and 3rd Streets, this average annual percentage is a slight increase, with a median value change of 0.96. It is reasonable to accept that property values on 1st Street have started increasing due to the two-way street conversion. Time and future property sales will determine if property values are indeed increasing in sync with the street conversion as seen on neighboring Brook Street.

Of the ten properties on 2nd Street that sold in 2013, six properties had a positive annual growth percentage since their last sale, three properties had a negative annual growth percentage since their last sale date, and one property had neither a positive nor negative annual growth percentage since its last sale date. The average annual percentage growth rate for 2nd Street was –0.38 percent once an outlier (rezoning/change of use) was removed. The median value change was 0.58. Property values on 2nd Street have decreased slightly since the 2011 conversion.

On 3rd Street, of the eleven properties that sold in 2013, six properties had a positive annual growth percentage since their last sale, and five properties had a negative annual growth percentage since their last sale date. The average annual percentage growth rate—once two outliers were removed—was 0.44 percent. The median value change was 0.35. Property values on 3rd Street have decreased slightly since the 2011 conversion.

Overall, property values and current property listings increased on both Brook and 1st Street since the 2011 two-way street conversion. The annual percentage growth rate was 21.62 percent. Since outside factors, such as the economic recession, may have influenced property values in the focus area, time is a critical element in determining the relationship between property value increases and street conversion versus a receding or recovering economy. However, one additional data point increases the odds that property values increased because of the two-way street conversion. The federal government's housing price index for Louisville, Kentucky, for the five-year period between 2008 and 2013 was –0.67 (FHFA 2013). This indicates that housing prices were down roughly 1 percent, as a whole, during that period. Assuming this is representative of the Louisville market, one can justly surmise that the two-way conversions did impact property values.

Qualitative Analysis

Though the collected data are limited to just one area, they do offer insights into the benefits of converting one-way streets to two-way. Our quantitative data illustrate that converting one-way to two-way streets can result in reduced traffic collisions, reduced crime, and improved property values. In the

three years since the conversion, traffic collisions decreased by 43 percent and 71 percent, while volumes of traffic increased. Conversely, traffic volumes decreased in the control sample of 2nd and 3rd Street, while collisions increased—something that should have been an anomaly, given the decrease in traffic. Data suggest that something about two-way streets makes them safer, more pleasant, and valuable—something that is perhaps better indicated through qualitative discussions and social ethnography.

In discussions with the community, the character of the streets was of great concern, but other themes emerged. Our interviews showed that, though most residents cite speed and safety first, they consistently discuss factors that influenced quality of life. As one resident noted, "Before the conversion we had several horrific car crashes that caused needless loss of life—several of whom were children." The same individual then went on to explain how the increased "sense of neighborhood brings pride of ownership." This inverse quantitative relationship between perceived livability and traffic speed is confirmed by a look at a co-occurrence chart that coded all mentions of these topics. As shown in Table 4, safety and speed are the dominant emerging themes. However, more ephemeral factors, such as "quality of life," "neighborhood pride," and being "good for business," are often mentioned. Some interviewed said they had opposed the conversion, and disagreed with the use of funding for that purpose, but felt the neighborhood had improved as a result of the conversion projects, perhaps because of the increased volume of traffic bringing business into the area. One vehement voice opposing conversion has since mellowed. His business has transformed, from struggling to profitable, and now he wishes to see adjoining streets converted from one-way to two-way because he thinks it would further increase profits.

Business owners in particular were vocal in identifying the positive effects of conversion: "Two-way streets are good for businesses and good for neighborhoods," with more pedestrians walking around the area and "a tremendous drop in cars flying by." This drop in cars did not mean a reduction in the number. Many were clear that there more cars were traveling slower and that this was a net benefit to business. As one man put it, "Speeding cars are bad for business and pedestrians." As another said, "Business is better two-way. People can see window displays easier because of a two-way, because traffic is slower, but also traffic increases considerably as well, so it is a win-win for business and neighborhoods." It is worth restating that there was no regulatory reduction in speed limit at conversion, making it likely that the slower traffic perceived by residents was a product of increased volumes.

In spite of the positive consequences of street conversions described here, some persons were not satisfied with the improvements. Most of these individuals felt that the improvements had either taken too long or not gone far enough. A few individuals argued that 2nd and 3rd Streets should have been converted as well. They described the confusion not about either the one-way or two-way streets but about the confluence of both—for example, turning into a street that turns out to be one-way. They also felt total conversion would increase business revenues even more. The information we collected helps provide insight into the reasons people give for avoiding downtown. They said things like "I hate going downtown because of the confusion and anxiety… [and] the lack of the proper signage that tells drivers which is the 'right way' and how to avoid the 'wrong way.'"

Taking the wrong way on a one-way street and seeing four lanes of cars barreling down the street can be terrifying and sometimes deadly if one "accidently" goes down the wrong way. It can create panic, confusion, and fear for drivers who choose to avoid the potential for deadly harm. In addition to these feelings of fear, in our observations, drivers felt that mixed types of streets created an opportunity for conflict. They stated that when one- and two-way streets were used together, "the seams" suffered and that more one-way streets needed to be converted to benefit local neighborhoods. By and large, however, the majority of these individuals felt that improvements were too few and too slow, and they wanted more—something that appeared to resonate when comparing the similar statements from other adjacent neighborhoods that have started to post signs lobbying for the city to bring two-way streets back to their neighborhoods as well (see Figure 8).

Conclusion

Given this analysis, we can conclude that there something about two-way streets that makes them safer and more desirable than one-way, multilane streets. Our empirical analysis shows that conversions can result in busier yet slower streets that have the potential to increase the vitality of an area and promote economic regeneration through fewer traffic collisions, reductions in crime, and increased property values.

In the area of traffic, we show that after the conversion of Brook and 1st Streets to two-way flow, there was a 36 percent and 60 percent reduction in total collisions. This was accompanied by an increase in traffic volume that was perceived as slower and beneficial, providing support for work that suggests that traffic engineers, business owners, and residents with children may speak a different language and have differing agendas when considering traffic flow. This is consistent with the observations of Vanderbilt (2008), who indicates that "to a traffic engineer, a 'traffic problem' might mean that a street is running below capacity. For a parent living on that street the 'traffic problem' could be too many cars, or cars going too fast. For a store owner on that same streets, a 'traffic problem' might mean there is not enough traffic" (p. 7). It is also consistent with the qualitative work of Appleyard (1980), who advocated for embracing "livable streets" in the United States. Slowing down traffic and

Table 4. Emergent Themes from Interviews Based on Code Co-occurrence Framework.

	Beatification	Crime	Housing quality/ improvement	More sales for business	More slower traffic	Neighborhood pride/sense of ownership	Property values	Quality of life	Safety	Speed	Traffic calming	Total
Beatification		1	1	1			2	1		1		7
Crime	1			1		2	1	1	4	4	3	17
Housing quality/improvement	1			1			3	2	1	1		9
More sales for business	1	1	1		1	1	1	3	2	3		14
More slower traffic				1					1	1	1	4
Neighborhood pride/sense of ownership		2		1				3	4	3	1	14
Property values	2	1	3	1				2	1	2		12
Quality of life	1	1	2	3		3	2		5	5	1	23
Safety		4	1	2	1	4	1	5		7	4	29
Speed	1	4	1	3	1	3	2	5	7		2	29
Traffic calming		3			1	1		1	4	2		12
Total	9	18	12	17	4	18	16	31	36	37	12	

Note: Darker shading indicates increased response frequency.
Source: Authors.

Figure 8. Yard sign from an adjacent neighborhood lobbying for two-way streets.
Source: Authors.

forcing drivers to pay attention to their surroundings can help increase safety and livability.

Second, we show a dramatic reduction in crime. Nearly three years after the conversions took place, crime dropped 23 percent. Auto theft alone decreased by almost a third on the converted streets, even as it climbed to 36 percent on the nearby multilane, one-way streets that composed our control group. Our interviews revealed that the conversion from one-way to two-way creates conditions for improved police surveillance and more evenly distributes cars. They indicate that crimes may be harder to get away with on multilane, one-way streets. Cars going both ways may mean more eyes on the street are looking in two different directions. This scenario counters the frantic commuter rush in the early morning or late afternoon, in which drivers travel at higher speeds.

Finally, we show benefit of increased property values. Property values have increased on these two-way streets, while those on nearby one-way streets (2nd and 3rd) have declined. The houses sold on both 2nd and 3rd Streets have seen a depreciation of 0.4 percent annually since their previous sale, while homes on the converted 1st Street saw an annual appreciation of 2.8 percent. Houses on Brook Street experienced an average annual appreciation of 11.6 percent. Now two-way, Brook Street has seen a 39 percent increase in properties sold after the change, perhaps benefiting from increased mobility, lower crime rates, and reduced traffic speeds. Given these facts, assuming home value appreciation is an indicator of neighborhood improvement, one can infer that a street conversion to facilitate traffic calming has some impact on neighborhood improvement.

All of this is not to say that neighborhood improvement and community development are simple. The issues affecting traffic and neighborhood safety and livability are complex and multivariate issues; we recognize there is no magical, quick fix. Although we provide proper controls in our research design, our study does not capture all local roadway dynamics, and the scope of our analysis is limited in duration. Furthermore, we recognize the costs associated with such conversions can be prohibitive for some cities. Costs include flipping signs and lights, changing signal timing, and the opportunity cost of lost street parking, in some cases (in Louisville, no parking was lost). The cost to convert both 1.25-mile segments (roughly ten blocks) in Louisville was estimated at $250,000 after pulling the two streets out of the regional STIP allocation bundle. This is within the same order of magnitude to other case studies provided by the U.S. Department of Transportation, which showed costs of conversion ranged from $124,000 to $140,000 (Harkey and Zegeer, 2004; Hopper, 2012). Larger, high-cost cities, like Vancouver and Minneapolis, have shown slightly higher costs that were surmountable (Ehrenhalt, 2009). In these cases, rather than waiting long periods to allocate regional Transportation Improvement Program funding, these locations chose to program local budgets for conversions. For example, Raleigh, North Carolina, programmed $2 million in city road maintenance funding to make such changes (Schrader, 2014), illustrating that when dedicated self-help transportation funding is available, cities can afford to make such changes. In the case of Louisville, regional funding was available and the city and community were willing to bear the costs, given the broader benefit of place making and urban regeneration that could save time, money, and lives.

And by every measurable aspect, 1st and Brook Streets are better places since they have been converted to two-way traffic. Yet Louisville is not an anomaly. Neighborhoods in cities around the country have multilane one-ways, often in areas that may be historically disadvantaged by race and class (Harwood, 2003). Though there is no panacea for improving neighborhoods, our case shows a clear example of road diets and traffic calming as ways to change the character of a neighborhood and that one-way to two-way street conversions can assist in redeveloping a community. The reduced traffic speeds and improved safety can allow streets to blossom with improvements: benches, trees and plantings, bike lanes, community gardens, public art, building renovations and improved property. Put simply, street conversions can be a win-win for neighborhoods—creating a more livable, safe, and prosperous environment that better reflects the rich past and vibrant, sustainable future of our cities.

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Note

1. Annual percentage growth rates for each property sold on Brooke and 1st can be found in the appendices.

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